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Translocating the Spiny Daisy

Sacred values and filthy lucre—taboo trade-offs in conservation

Wildfire reveals new populations of endangered species in the Wollemi National Park

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SUSTAINING PLANT DIVERSITY—ADAPTING TO A CHANGING WORLD

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Correction: The graph on the Wild Native Rose printed on Page 10 of APC 23(2) for the article written by Kate Brown and Cathy Bourke was missing one set of data and will be corrected in an on-line version of this edition to be posted on the ANPC's website on the 14th of May 2015.

Front cover: Following wildfire in the northern parts of Wollemi National Park, the largest known populations of the Hunter Valley endemic *Commersonia rosea* were discovered. Here, a flower and densely-haired fruiting capsule of the endangered species. Photo: Stephen Bell.

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From the editor

Huw Morgan

Welcome to the second of two issues publishing articles from the 10th Australasian Plant Conservation Conference held in Hobart in November 2014. The theme for the conference was *Sustaining Plant Diversity – Adaptation to a Changing World*.

It was my pleasure to attend the conference and meet and hear from a range of authoritative, passionate, and distinguished plant conservationists. With over 50 presentations in three concurrent sessions, along with a keynote address and four plenary lectures, the three-day conference was packed full of information and ideas.

At the conference, presentations were organised by five sub-themes: *Securing Biodiversity*, *Partnerships for Biodiversity*, *Prioritising Actions*, *Animals in Plant Conservation* and *Engagement and Communication in the Modern World*. I haven't sought to organise the publication of papers by subtheme – largely for practical reasons, but I also think it makes for less intrusive editing and more interesting reading.

In this issue, don't miss articles including contributions from conference Plenary speakers **Terry Walshe** (exploring taboo tradeoffs and other issues in conservation prioritisation) and **Andrew Smith** (exploring how a passion for the natural world tends to drive people to do wonderful conservation work). An excellent collection of other conference articles, the third installment of **Dan Cole** and **Greg Siepen's** large-scale reforestation series and a suite of reviews of recent books make for perfect cool-weather reading.

Wildfire reveals new populations of the endangered *Commersonia rosea* and *Monotaxis macrophylla* in northern Wollemi National Park, NSW

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Wollemi National Park (Wollemi) conserves around half a million hectares of wilderness country to the north-west of Sydney. It adjoins the Blue Mountains National Park, and together with Yengo National Park forms a large component of the Greater Blue Mountains World Heritage Area. Surveys of the vegetation in this vast area have been ongoing since the 1990s, but the rugged topography and range of habitats present ensures that new findings are not unexpected.

In an earlier paper (Bell 2008), 94 plant taxa of national and NSW conservation significance were documented for Wollemi, where it was also forewarned that additional threatened species and populations probably awaited discovery. Continuing surveys in the park since 2008 have now revealed additions to this list, including *Dillwynia tenuifolia* (Endangered), *Eucalyptus fracta* (Endangered), *Grevillea parviflora* subsp. *parviflora* (Vulnerable), *Acacia alaticaulis* (rare), and *Eucalyptus michaeliana* (rare). New information on population size and ecology has also been reported for the Endangered *Pultenaea* sp. Olinda (Clarke 2013a, b), *Baeckea kandos* (Clarke 2014), and *Apatophyllum constable*, the latter now removed from the NSW *TSC Act 1995*. In addition, work is continuing on the taxonomic placement of *Eucalyptus* sp. aff. *fibrosa* (Yarrawa), briefly documented in Klaphake (2010), and *Eucalyptus* sp. aff. *prava*, a mallee redgum formerly included in *Eucalyptus dealbata* (Bell 2001). These additional species now push the total significant species found within Wollemi up towards one hundred: an impressive total for a single conservation reserve.

Commersonia rosea

Of most recent interest has been the discovery in 2014, following a wildfire in the northern parts of Wollemi, of the largest known populations of the Hunter Valley endemic *Commersonia rosea* (Endangered). This fire burnt around 50 000 hectares of rugged bushland during mid-October 2013, and in some areas was particularly severe. During bushwalking forays into this section of the park, the second author happened across a population of many thousands of plants (>10 000 individuals) along one of these burnt ridgelines, all flowering and fruiting freely in the freshly opened canopy. This population extended for at least 2 km more-or-less continuously along the exposed ridgeline and north-west facing slopes; in places, completely covering the ground. Many more plants were also found on the ridge to the immediate north of this population, extending for 10 km but not at the same densities. *Commersonia rosea* was described as a fire-ephemeral, and prior to this new population was known in conservation only sparingly from Goulburn River National Park, with additional populations in Crown reserve south of Manobalai Nature Reserve (Bell and Copeland 2004). The largest population prior to this find was thought to be perhaps several hundred plants, and it was postulated that the wide expanse of northern Wollemi offered considerable potential habitat.

Commersonia rosea, flower and fruiting capsule.
Photo: Stephen Bell.

The finding of such a large population in secure tenure, and the probability that other stands of similar magnitude may be present along other ridges in northern Wollemi, and perhaps also the adjacent Goulburn River National Park, suggest that a review of the conservation status of this species may be warranted. In the past, de-listing of other species has occurred following the discovery of new and secure populations: *Apatophyllum constable* for example was de-listed from NSW legislation in 2007 largely in response to the finding of 6000–7000 individuals in south-western Wollemi (Steve Clarke, pers. comm.). The ridgelines where the new populations of *Commersonia* have been found have not experienced fire for at least 30 years, and possibly up to 70 years (NSW Office of Environment and Heritage, pers. comm.). This would suggest that the seed bank has remained viable for 30–70 years, and presents an interesting dilemma. While there are clearly many thousand *Commersonia* individuals currently present within Wollemi, in 3–5 years nearly all of these plants will have died back, and the species will once again disappear into the seed bank until the next fire event. Should species such as this continue to be protected under threatened species legislation? When present within secure tenure such as national parks, and with such a resilient seed bank, it would seem that few threats are active and the species may be safely de-listed.

Monotaxis macrophylla

Also present within part of the *Commersonia* population were several stands of another fire-ephemeral: *Monotaxis macrophylla*. This species has a widespread distribution in NSW, from the North and South Coasts and the central parts of the state, and is also present in Queensland (Halford and Henderson 2002). It is currently listed as Endangered in NSW, but few populations are known. Gibson (2002) recorded *Monotaxis macrophylla* near Crypt Hill in north-western Wollemi over a decade ago, but no other records are known for the Hunter Valley. The new populations occur along the same ridgelines which support *Commersonia*. We estimate that several hundred plants, perhaps thousands, are present, although as with the *Commersonia* there are likely to be more than this given the extent of burnt country that is yet to be explored.

Monotaxis macrophylla flowers and fruits.
Photo: Stephen Bell.

Conclusions

Wildfire can be a devastating phenomenon in wilderness areas, but it can also bring renewal and change. *Commersonia rosea* had not been recorded from Wollemi prior to this wildfire event, and there was but a single record of *Monotaxis macrophylla* from the park. This is despite the history of survey that has been carried out in northern Wollemi since at least the early 1990's, including detailed inspection of one of the ridges reported on here as recently as 2012. The moral of the story? Botanists should remain diligent when inspecting areas after wildfire, and observations on threatened species such as these should be noted and reported appropriately.

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Translocating the Spiny Daisy: partnerships with winning outcomes

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Background

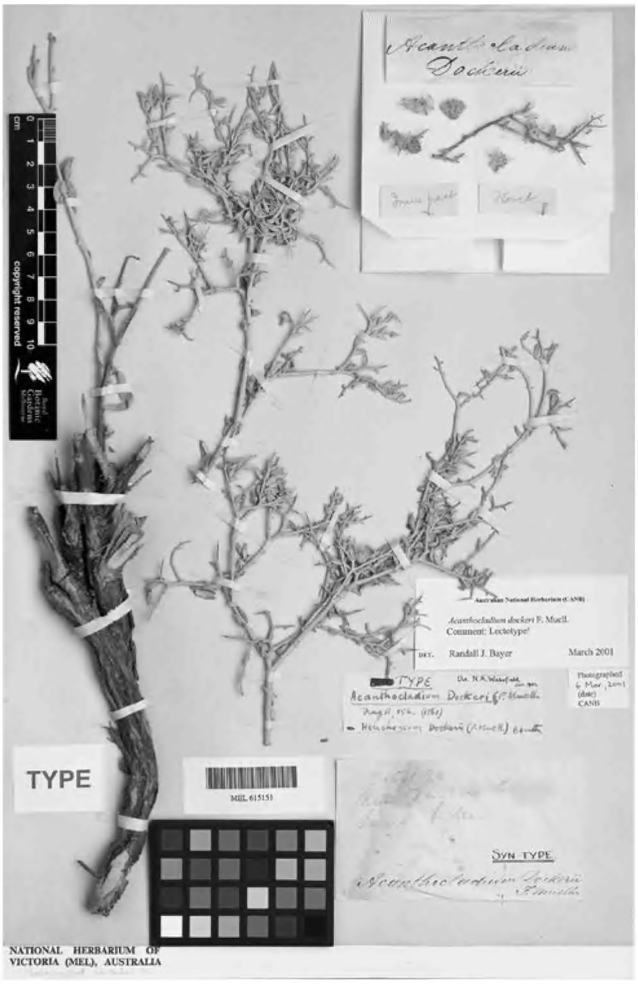
The Spiny Daisy (*Acanthocladium dockeri*) is a low-growing grey-coloured perennial shrub with sharp spines, small indistinct leaves and yellow composite flowers. The genus *Acanthocladium* is monotypic, and the species is currently known only from extant wild populations in South Australia's Mid-North. Spiny Daisy is listed as Critically Endangered under the *Environmental Protection and Biodiversity Conservation Act (1999)* and as Endangered under South Australia's *National Parks and Wildlife Act (1972)*.

History

The Spiny Daisy was first described by von Mueller from specimens collected in 1860 by botanist Hermann Beckler on the ill-fated Burke and Wills expedition, near the Menindee Lakes in western NSW. It was another 50 years before a second collection was made, near Overland Corner in South Australia's Riverland. By the 1980s, despite concerted efforts to find the plant at these locations, the Spiny Daisy was thought to be extinct. It was in the 1990's that the shrub was re-discovered through good fortune, growing 200 kms away on a roadside near Laura in SA's Mid-North, by local farmer Paul Slattery who was collecting and identifying native plants simply out of interest. In the 20 years following the Laura discovery, another five populations have been identified, all in the Mid-North of SA, and all growing on roadsides in highly modified habitat.

Threats and Recovery Actions

The Mid-North of South Australia has been extensively cleared for agriculture, and now has only scattered remnants of intact native vegetation. As a consequence, the wild population of Spiny Daisy is highly fragmented, and being confined to roadsides, the sites are threatened



The type specimen for Spiny Daisy, collected on the Burke & Wills expedition (1860). Photo: National Herbarium, Victoria.

by road and roadside maintenance activities such as grader damage and off-target herbicide damage. The plants are also subject at times to heavy attack from exotic white snails (most commonly *Cernuella virgata*), an agricultural pest which invades cereal crops.

The other major impediment to the Spiny Daisy's recovery is the fact that the species is strongly clonal (Jusaitis & Adams 2005, Adams 2013). Viable seed production is poor, seedling recruitment is lacking and genetic diversity is low (Jusaitis & Adams, 2005). In effect, the six sites appear to be clonal populations reproducing vegetatively, although there is genetic differentiation between sites (Adams, 2013).

Weed and snail control is being undertaken at all sites, to the benefit of the Spiny Daisy, and road maintenance activities have improved following discussions with local government. Nevertheless, the most important conservation measure to guard against extinction risk has been translocation. To date, 11 conservation plantings have been established in the Mid-North, and one in the Riverland, either to boost extant populations or as introductions to new sites. There have also been some plantings for educational purposes, including the Botanic Gardens in Adelaide and in Canberra. Some of these plantings have been successful, while others have failed.

*The Melrose population of Spiny Daisy.
Photo: Manfred Jusaitis.*

The Benefit of Partnerships

The Spiny Daisy Recovery Project has successfully increased the likelihood of survival for the species, largely due to the strong partnerships that have been developed since the project's inception, between Government, NGOs, private individuals and private enterprise.

Following the discovery of the Laura population of Spiny Daisy, the community group Threatened Plant Action Group (TPAG) successfully applied for funding to draft the first recovery plan, search for more populations and undertake the initial genetic studies. During this time another three populations were discovered and the findings of the first genetics study helped determine the actions needed in the first recovery plan. The TPAG model of recovery has a strong on-ground focus, and minimal disturbance weeding techniques were employed at the regular working bees.

Eventually the project was handed over to the Department for Environment and Heritage (DEH) and was managed by Northern and Yorke region. DEH opted to contract Greening Australia (GA) to undertake maintenance of the sites. GA employed Paul Slattery, the farmer who had made the Laura discovery. Paul's local knowledge and community network skills ensured the project gained local awareness and credibility, which was invaluable. By passing on responsibility for site maintenance to GA, DEH ecologists were able to focus their efforts on translocation trials at a small number of sites.

In 2008, the recovery team was able to attract funding from the Foundation for Australia's Most Endangered (FAME). This funding was used to establish a number of translocation sites, this time targeting landholders willing to have Spiny Daisy populations established on their properties. The team was able to build on the lessons learnt from the initial translocations, and also gained access to larger, more intact remnants of suitable habitat.

Over the last few years, NGO Trees For Life (TFL) has taken over the contract for maintenance of threatened flora sites in Northern and Yorke region, including Spiny Daisy. Using a similar approach to TPAG, TFL's Erica Rees has worked hard to improve the condition of the remnant and translocation sites, with volunteer assistance from Biodiversity and Endangered Species Team members and TFL's Bushcare Action Team.

In 2013, the recovery team decided to further reduce the risk of extinction by undertaking a translocation in the Riverland, where Spiny Daisy had been found 100 years ago. After intensive searches of the area it was decided to approach Banrock Station with a translocation offer. The well-known wine label owns a large Riverland property with vineyards, but also a substantial area of intact remnant vegetation, including the Banrock Station RAMSAR Wetlands. By good fortune the property is also situated on the opposite bank of the Murray River from Overland Corner, where South Australia's first Spiny Daisy record was collected. Banrock willingly accepted the offer, and subsequently their two ecologists propagated cuttings from all six wild Spiny Daisy populations at their on-site nursery. Three suitable trial sites were chosen; the sites have been fenced initially to exclude herbivores until establishment, and the young plants will be irrigated in the early stages.

Spiny Daisy cuttings being propagated at Banrock Station's nursery. Photo: Christophe Tourenq.

On 24 July 2014, the cuttings were planted by representatives of the organisations involved in recovering the Spiny Daisy from extinction, making it a great example of positive partnership between a conservation-minded private company, government agencies and an NGO dedicated to nature conservation. Depending on the success of these trial plantings, the plan is to undertake more in subsequent years. The media exposure resulting from this partnership with private enterprise greatly exceeded our expectations, and has greatly improved the public's awareness of the Spiny Daisy and its plight. All of the partnerships formed in this project have been both successful and rewarding for different reasons.

Planting day at Banrock. Photo: Christophe Tourenq.

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Using seed production areas to meet restoration targets and secure genetic diversity

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Collecting seed from native vegetation can sometimes be fraught with disappointment as the amount and quality of seed produced can vary widely from year to year. Many factors including seasonal variability, water availability and reduced genetic diversity can impact on seed quantity and quality. However, despite the increasing demand for seed to meet restoration targets being acknowledged, we remain reliant on remnant native plant populations to produce what we require (Broadhurst et al. 2015). It is also now well recognised that the seed we use for restoration must have a broad genetic base if vegetation is to adapt to changing environmental conditions. In highly cleared regions however, remnant plant populations can have low genetic diversity and are producing poor quality seed.

Seed production areas (SPAs) are one way to ensure that we can produce the large volumes of high genetic quality seed needed for restoration projects. SPAs also have other benefits such as (1) reducing the burden of collection through more efficient collection practices, and (2) reduced over-collection from remnant native vegetation, especially in small populations where seed also helps to support our native animals and insects. Furthermore, broader funded restoration programs require a seed supply of diverse species across the variation of vegetation types in the landscape, with sufficient quantity of seed to meet area targets and broad scale direct seeding requirements.

In other countries such as the United States of America, SPAs are helping to restore large areas of grasslands (e.g. western prairies). SPAs however are not widely used in Australia as a means of securing the seed supply chain, i.e. having a regular supply of high quality seed. Investment in SPA establishment and maintenance can be high with returns taking several years to be realised making it critical that investors are confident in the quality of seed being produced. Consequently, SPAs need to (1) have high levels of genetic diversity, and (2) be representative of natural populations found in the region where restoration is occurring.

Assessing the genetic diversity of SPAs: a case study in the Goulburn Broken catchment

We evaluated the genetic quality of remnant populations and SPAs of *Acacia montana* and *Dodonaea viscosa* subsp. *cuneata* located in the Goulburn Broken CMA in Victoria to determine the quality of seed being produced and whether this could be improved. In this study we were dealing with three generations of plants; (1) the original remnant population plants (although these are likely to consist of several generations of plants in their own right), (2) mature seed production area plants (i.e. the mix of remnant populations), and (3) offspring (seed) from the SPAs and original populations. We first compared levels of genetic diversity and inbreeding in the SPA plants to that in their source remnant populations, followed by a similar comparison of genetic diversity in seed produced by the SPAs and remnant populations.

Our results showed that genetic diversity was similar among the remnant plants, SPAs and seed (third generation juveniles) for both species. This finding demonstrates that the 15 years of work by the Goulburn Broken Seedbank, Goulburn Broken CMA and partners has created SPAs producing seed with levels of genetic diversity similar to that found in remnant populations. There was, however, some concern associated with inbreeding in one of the SPAs from each species. This finding reflects that although the levels of diversity are similar among the three generations of plants, when genetic diversity of the source remnant populations is already low, inbreeding can occur. By understanding the potential for collecting inbred seed from wild populations and SPAs, the Goulburn Broken Seedbank always mixed appropriate seed collections with SPA seed for projects to increase the genetic diversity of seed and species being restored in the field.

We also assessed how well the SPA plants represented the types of genetic diversity present in the remnant populations, i.e. did the SPAs contain an even mix of genotypes from each remnant, or were some genotypes from some populations more common than others? This is important to know because if one population is more abundant than the others then the seed produced is essentially recreating this population only, the outcome being another small, inbreeding population. We found that both of the *A. montana* SPAs primarily contained genotypes of one remnant population only. So, while these SPAs are producing levels of diversity similar to that in the remnant populations, the seed is mostly similar to that one population. It is not clear how this occurred but it may be that although many different seed sources were used during SPA establishment, the majority of plants that survived came from this population only. This highlights how important it is to track plants from SPA establishment to maturity to ensure that representatives from each source population survive. Having this information is important as now steps can be taken to add new plants to the SPAs to even out genetic representation. The *D. viscosa* subsp. *cuneata* SPAs were considerably more representative of their wild source populations, but that some additional plants would also improve their value as seed sources.

Summary and Future Steps for the Goulburn Broken SPA Management

Our findings indicate that although some deficiencies in these SPAs were observed, overall the seed being produced is a useful source for restoration projects within the Goulburn Broken CMA, especially if mixed with other sources. The study also highlights that bringing together seed from small populations into a SPA can help to increase genetic diversity and limit inbreeding. Supplementing the SPAs with additional plants from new remnant populations will add further value to these valuable seed sources. SPAs can be a useful source of high genetic quality seed, provided they are carefully established and evaluated with an active management program to add diversity and replace senescent plants during the SPA lifetime.

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The Jaliigirr Biodiversity Alliance – connectivity is key

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We live in a hyper-connected world. Our connectivity via digital media is having huge social, political and economic impacts on our everyday lives. These impacts stretch beyond the digital world, and it is being increasingly recognised that social connectivity is a central feature of a flourishing life.

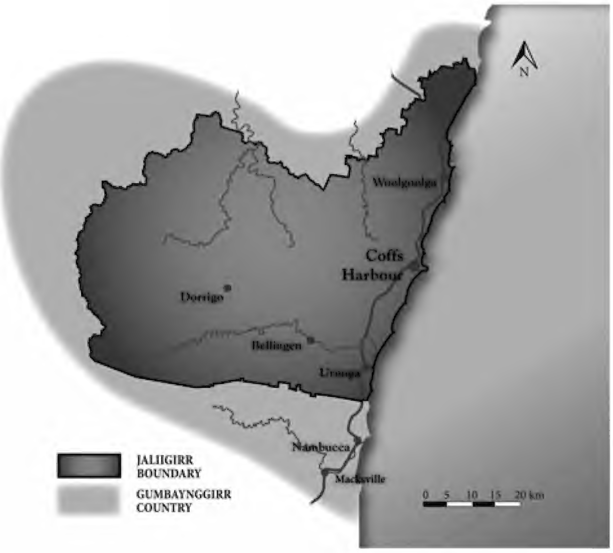
In the ecological world, connectivity conservation is also recognised as a fundamental principle of ecosystem resilience, climate change adaptation and improved conservation outcomes (Worboys and Pulsford 2011). On the mid north coast of New South Wales, the Jaliigirr Biodiversity Alliance (JBA) was formed to facilitate all these aspects of connectivity.

About the Jaliigirr Biodiversity Alliance

The JBA was established in late 2011 and is one of the regional partnerships of the Great Eastern Ranges initiative. The alliance consists of 20 different partner groups. It was established primarily to support and promote the conservation activities of organisations, landholders and communities to create corridors to link World Heritage areas, National Park reserves, State Forest and private land. These many contributions strengthen and expand habitat and migratory routes for adapting species, and improve and protect the biodiversity within these ecological communities.

Covering an area of 337 000 hectares, the JBA area of interest stretches from the seaboard of the Coffs Coast to the Dorrigo plateau, one of the few places where the mountains of the Great Dividing Range and the Great Escarpment connect to the coastal plain. The area's unique biogeography provides for a wide range of environments and consequently a remarkable biodiversity. Distinctive mixtures of tropical, sub-tropical and temperate assemblages, over 100 vegetation communities, high numbers of endemic and threatened species and endangered ecological communities are represented as well as the World Heritage Gondwana Rainforests of Australia.

The JBA area of interest exists mainly within the Gumbayngirr Aboriginal nation. "Jaliigirr" is the Gumbayngirr word for tree and is used as a symbol of connectivity by the JBA. The alliance seeks to recognise the attachment of Aboriginal communities to landscape and natural resource management through meaningful involvement and activities. As stated by Uncle Larry Kelly, a Gumbayngirr Aboriginal Elder at a recent partners forum: "Gumbayngirr Jaliigirr wajaar – Jaliigirr land. In this tribal area we all belong to the land and we all should be on the one idea – all part of a group and tribal area managing Country together."



Map of the area covered by the Jaliigirr Biodiversity Alliance.

Tree planting at Wenona Headland by Darrunda Wajaar (the Coffs Harbour Aboriginal Green Team) and Macksville Primary School. Photo: Charlie Brennan.

Partner groups of the JBA include the NSW Office of Environment and Heritage, Local Land Services, Bellingen and Coffs Harbour Councils, Aboriginal Land Councils and Elders and environmental restoration groups. Over $3 million for six years was secured through the Commonwealth Government's Biodiversity Fund and the Great Eastern Ranges Initiative. This funding is for activities that protect and enhance landscape connectivity, as well as to carry out community engagement strategies that promote environmental awareness and connectedness to our community and environment. Below is a snapshot of some of the JBA projects and activities.

On-ground projects

A range of on-ground projects are underway targeting high conservation value corridor enhancement and revegetation. "Connecting Corridors through Communities and Culture" (C4) is the largest project, administered by North Coast Local Land Services. Work has been done on 21 priority sites including 43 private landholdings, one on Forestry Corporation land, one on National Park, within Koala corridors and 96 other linking sites (Fig 2).

Several C4 on-ground projects were done by the Coffs Harbour Aboriginal Green Team (Darrunda Wajarr) and the Dorrigo Aboriginal Green Team. The work provides important training and experience as well as the opportunity to work "on country" for Aboriginal people, which contributes to strengthening the communities' connection to significant cultural landscapes.

Innovations and events

As well as on-ground works, the JBA is investigating a range of innovative techniques to promote cultural change through engagement strategies and regular themed partner's events, working with the Aboriginal community to restore landscapes, and social marketing techniques. Themed events have included:

- **Threatened Species – everybody's business.** This event highlighted that threatened species conservation is not only the business of government departments, but the whole community, through personal choices, can contribute to the conservation of threatened species. The event showcased the range of threatened species projects within the JBA, and their location.
- **Sense of place.** A "sense of place" arises through acknowledging and building connection between people and their environment; knowing its stories, history, flora, fauna, climate, its buildings and community. Exploring and engendering a sense of place encourages respect and protection of those places. The JBA have facilitated a number of community activities promoting and understanding sense of place (for more on sense of place, see Cameron 2008).
- **Embracing the Aboriginal community.** The JBA respects and acknowledges the timeless connection of Gumbayngirr people and the land. The alliance seeks to incorporate Aboriginal cultural connection to the landscape within all of the Alliance partners through involvement of local Aboriginal land councils and elders as well as employment and training opportunities. At Wenona Headland, a repair to country and stories event celebrated Gumbayngirr connection to the landscape. Attended by elders, Aboriginal and non-Aboriginal school children, partners and landcarers, the event included a tree planting run by the Aboriginal Green Teams and a story circle run by elders.
- **Economic value of the NRM industry.** A cost-benefit exercise involving all JBA partners calculated that over $5 million each year is brought into the area from NRM activities. This is a significant input to a small, regional community.

- **Film.** The Jaliigirr area and projects are showcased in a short film produced by a local film maker. This is available at https://www.youtube.com/watch?v=LeyPuDM4Ftc.
- **Community-based social marketing.** Many of the innovations of the JBA are underpinned by considerations of how to promote behavioural change to encourage environmental sustainability. Community-based social marketing looks at creative solutions that are finely-tuned to specific behaviours. For example, a "dog's breakfast" was held on a local beach where nesting shorebirds were affected by people's unleashed dogs. A free sausage breakfast was provided to both dogs and owners where management needs of the shorebirds could be explained to dog owners. Workshops and training are underway to further this practice within the JBA.

Case Study – Moonee Quassia

Many of the projects outlined above are broad-scale; either across landscapes or communities. JBA projects also include management of individual significant species, including community awareness and engagement techniques.

An example in this case is of the Moonee Quassia (*Quassia* sp. Moonee Creek), an endangered shrub that has almost its entire range within the JBA area of interest. The most significant population of this species lies within a regional corridor linking the coast to the hinterland. A major threat to the population is vegetation clearing for intensive horticulture associated with the rapidly developing blueberry industry. Bush regeneration and revegetation are being coupled with investigation of unique approaches to engage with the blueberry-growing community to promote the value of threatened species and habitat.

After nearly three years of operation, the JBA has developed into a strong conservation partnership and continues to seek funds beyond the current funding timeline. Support for the alliance continues to be strong through government agency assistance. With further funding, the alliance will seek to continue and expand upon connecting and healing the landscape and working with the connectedness of the community through a range of initiatives.

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The New Zealand Plant Conservation Network

Rewi Elliot

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The New Zealand Plant Conservation Network (NZPCN) is a registered incorporated society, with a Council made up of four to nine members. Currently our membership stands at 420 individual members.

The NZPCN was established in 2003 with the vision that:

> *no indigenous species of plant will become extinct nor be placed at risk of extinction as a result of human action or indifference, and that the rich, diverse and unique plant life of New Zealand will be recognised, cherished and restored.*

Activities of the Network

Our flagship activity is the Networks website: www.nzpcn.org.nz. The website receives about 80 000 website visitors a year. Most visitors access our plant factsheets, of which we have completed 1651 for native vascular taxa – a further 808 remain to be completed. The site has almost 20 000 images which are available on request to download. If you haven't been on the website it is well worth a look, you can Google NZPCN and find it immediately.

Other activities include:

- An online shop selling various publications, including our four training manuals. Two of the best sellers are the *Introduction to NZ plant life* and *How to manage a native plant nursery*.

- A monthly newsletter *Trilepidea* with articles from around the country and details of upcoming events. We would welcome newsletter contributions from ANPC members; this can be done simply by emailing info@nzpcn.org.nz.
- Administering the David Given scholarship of up to $5000 for tertiary student research along with the recent endowment fund which we hope to increase to over $1 million to support future applications for practical plant conservation funding.
- Organising a biennial conference, the next of which is in Dunedin in October 2015 leaving plenty of time to save up and come across from Australia. This year's theme is *Nurturing our conservation roots for generations to come*.
- Hosting the annual NZPCN conservation awards. The awards aim to recognise people who make outstanding contributions to plant conservation around the country.
- Promoting the annual *NZs favourite native plant* competition to promote New Zealand flora. Details are provided on the website if you're interested in voting.
- Supporting the New Zealand Indigenous Flora Seed Bank. This is a project to collect seeds from New Zealand flora, building on the Memorandum of Collaboration initially signed between NZPCN and the Millennium Seed Bank, RBG Kew. The seedbank steering group now comprises representatives from NZPCN, AgResearch, the Department of Conservation, Landcare Research and Massey University.
- The development of a mobile application that will describe 594 New Zealand native woody trees and shrubs, developed with funding from the Department of Conservation.

Any visitor to New Zealand interested in plants and plant conservation is more than welcome to contact NZPCN. I'm sure wherever you are visiting we will be able to find a connection to enhance your experience of New Zealand.

In defence of ferals and weeds

Paul Gibson-Roy

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Pest animals and weeds present great challenges for conservationists, society and the environment. They are often described by our sector as the greatest threat to native ecosystems and biodiversity, not only in Australia but world-wide. The language used in relation to these organisms is often evocative (e.g. invaders, monsters, villains) and ascribes intent and blame. But are they really the villains we think they are? Humans have done much to alter the terrestrial biosphere, and in this process have dramatically altered, degraded and simplified ecological systems. Some of the consequences of these changes are exhibited in the impacts caused by those species we term weeds and pests.

In Australia we commonly talk about the competition and habitat loss impacts of weeds and feral animals upon native species. Contemplate these notions in the context of Australian Bureau of Statistics figures, which reveal 61 per cent of the Australian land mass is now used for agriculture: that is for the growth of largely introduced crop or pasture species and the production of meat and fibre from domesticated exotic herbivores. In 2013–14, agricultural lands supported a herd of 72 million sheep, 28.5 million cattle and 2.3 million pigs and in 2010, 26 million hectares were dedicated to the growth of annual crops. Across this huge footprint, we nominally tolerate a limited suite of small birds, mammals and reptiles (much focussed on by our sector), but a large part of what was the natural pre-human biota is now either reconstructed, not present or not welcome from a huge proportion of the landmass (even more if you take into account the urban and other human footprints).

Many of the exotic plants and animals we term "weeds" and "ferals" dominate parts of our Australian landscapes because humans create ideal conditions for them to do so. To grow crops and pastures, in 2012–13 farmers applied two million tonnes of synthetic fertilisers across 58 million hectares. Research has shown these nutrients overwhelmingly favour the growth of weed over native species (Dorrough and Scroggie, 2008). Not surprisingly, across the broad tapestry of our so-called iconic Aussie agricultural landscape, native plant communities struggle to compete while exotics thrive.

Agricultural systems are very effective vectors for the spread of weeds. For example, Australia produces approximately nine million tonnes of fodder hay each year, the bulk of which is transported to and from distant reaches of the country. Some component of this animal feed would inevitably contain undesirable weed seed, relocated to new locations. A similar situation arises with the movement of stock; huge numbers of cattle and sheep are routinely moved between Australian regions, their hide and fleece, hooves and dung carry various types of seeds from their place of origin to new locations. Even if fodder and animals were to carry no contaminants, the trucks that transport them pass through countless kilometres of rural lanes and roads covered in weed species. Studies have shown that vehicles of all types are prolific inadvertent carriers or seeds, pests, diseases and soil borne pathogens.

What other human induced changes have helped to create the problems we face from weeds and ferals? In natural ecosystems, communities are constituted by complex interacting webs of predators and prey, producers and consumers. In our simplified anthropogenic landscapes, trophic complexity has been purposefully decimated; the balance (as viewed in complex systems) is absent and weeds and ferals seem a logical consequence. Humans vest much purpose in holding vast tracts of the planet in these simplified unbalanced states. In Australia it takes a huge input of will and resources to maintain millions of hectares of land for single species annual crops, but we do it, year after year, decade after decade. In some parts of the world it has been done for millennia.

In complex trophic systems, particular species will act as controlling forces on others (directly or indirectly). However, in Australia, as with most other parts of the world, critical megafauna (those non-domesticates) and apex predators are essentially absent and their moderating or influencing capacity lost. Sadly, it is clear humans do not tolerate species which threaten our lives or livelihood or do not contribute to it (and this has been the case throughout human history). Some of the consequences of this human eradication and simplification of nature are seen in Australia. Here, all the native apex predators have been killed off. For a variety of reasons the same treatment is levelled at large introduced predators such as dingos and wild dogs. However, without apex predators as controlling influences, other species such as foxes, pigs, donkeys, deer and cats can run amuck, and do. Similar unwanted consequences can arise when we use sophisticated and novel technologies (such as the calici and myxoma viruses) to target and control individual species (like rabbits). Here we must brace ourselves for unwanted outcomes, such as when sudden and dramatic declines in rabbits as food sources occur and already large fox populations turn their gaze to small native mammals.

Figures developed through the National Weed Strategy suggest that the national cost of weeds and pests to agriculture is $4 billion annually and approximately the same amount for the conservation and amenity sectors. To deal with such issues, the Federal Government in its 2012–13 budget through the Caring for Our Country program allocated just $13.8 million annually (over seven years) for pest and disease eradication and $5 million annually (for five years) to strengthen biosecurity. Even in an area such as biosecurity, where one might assume protection of environmental resources is the focus, settings and investment parameters are predominantly focussed on the protection of agricultural industries rather than native communities (Lynch 2014). However, while many might bemoan the lack of government support for mitigating the impacts of weeds and pests, voters routinely elect governments that spend on people not the environment. Of the $398 billion 2012–13 budget, $230 billion was spent in just three areas: social security and welfare, health and education (this excludes large amounts for defence and the public service). It is clear that when it comes to spending on environmental issues, our society's money is not where its mouth is.

It is clear the issue of weeds and ferals has been tragically over-simplified for public consumption, with dire consequences. Sadly this is often exacerbated by discourse from the environment sector, which can tend to frame the issue as simply native versus exotic (where native is good and exotic, bad) rather than treading the more difficult path of articulating and communicating the complexities associated. There is no doubt that certain plants and animals create huge challenges for humans and impact negatively on non-human communities. But in the age of humans, most of these issues are a consequence (direct or indirect) of our actions. All Australians rely and benefit on the products of agriculture and so share the responsibility for agriculture's impacts on the natural environment. The same can be said for the impacts and benefits of other industries (including energy and extractive industries) and not forgetting the cumulative footprints of our towns, cities and associated infrastructure.

The direct and indirect impacts of humans on other species is one that should be acknowledged and mitigated as best we can as a society. The organisms we term weeds and ferals simply behave as they have evolved to do so, taking advantage of the conditions and opportunities as they arise. Unlike humans, animals and plants do not plot and scheme. There are no smoke-filled rooms full of cane toads and foxes strategising and planning their next push into uncharted human territory! They move as they are able (or as in the case with foxes into Tasmania, as they are moved by humans). For the one species seemingly capable of higher thought, we humans have been quick to attribute blame on weeds and ferals. I think this diminishes us and denies them dignity to be what they are, living organisms doing their best to survive and reproduce as they can. For this act, humans and our sector in particular, should not demonise them for being what they are in a world we have grossly altered for our own purposes.

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Towards new nursery industry protocols for *Phytophthora* control: supply of stock for restoration and revegetation

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Abstract

The threat to Australian plant life and biodiversity from existing and potential additional forms of *Phytophthora* is real and well documented. Some 50% of Western Australia's endangered flora is susceptible to *Phytophthora* dieback. Whilst there exist a range of modes by which *Phytophthora* could transfer to valuable conservation areas, a very obvious and likely source is transmission via nursery sourced plant stock.

The current nursery industry accreditation standards and compliance framework, though better than none, are no longer considered adequate to address the current and prospective threat to Australian flora posed by *Phytophthora* from nursery stock. To ensure best environmental outcomes, a greater focus on pathogen management is required from nurseries and their clients.

This paper will outline a range of views for improving nursery protocols for *Phytophthora* management, in particular to avoid introduction of *Phytophthora* in plant stock to conservation areas.

Background

Plant science has continued to identify additional *Phytophthora* species and pathotypes, some of which have the potential to cause significant additional damage to both native and exotic flora. The recently revised National Phytophthora Threat Abatement Plan (Department of the Environment 2014) clearly identifies the risk of pathogen transmission from nursery stock.

The author has been involved in the production of plant stock for restoration and revegetation for the last 12 years and founded a Perth native plant nursery and associated environmental contracting and consulting business. While concerns for plant quality and hygiene standards within the nursery industry have previously been noted (Hancock 2010), the author is not yet aware of improvements to hygiene standards within the industry, or in any particular nurseries supplying stock for restoration and revegetation. The requests for testing have been principally driven by The Department of Parks & Wildlife relative to their direct purchases as well as imposing similar conditions on conservation groups involved in restoration work on DPaW managed lands. Recently, our clients, including state government and associated providers, have become aware of the potential threat of *Phytophthora* introduction via plant stock, and are requiring soil sample testing for *Phytophthora*.

The requests for testing have been principally driven by the Department of Parks and Wildlife (DPaw) relative to their direct purchases as well as imposing similar conditions on conservation groups involved in restoration work on DPaW managed lands.

Supply of plant stock for restoration: current industry deficiencies

Current standard practices in the nursery industry include a number of deficiencies which pose environmental risks. These include:

- Sourcing stock from non-accredited nurseries.
- Inconsistent compliance with industry accreditation systems across nurseries.
- Lack of an agreed methodology for soil testing.
- No agreed or documented system by which nurseries can recover from positive *Phytophthora* testing.
- Acceptance of the need for a higher *Phytophthora* control standard, particularly regarding supply of plant stock to conservation areas.

Risk sources for nursery infection

There exist a number of sources of entry for *Phytophthora* into nurseries. Below, I identify the most likely sources of infection of nurseries – these would represent some of the most important sources to be dealt with in any *Phytophthora* management protocol:

- Drainage runoff entry to nursery.
- Nursery ground soil or water supply.
- Contaminated soil from vehicles, boots, tools and equipment.
- Inadequate sterilisation of recycled plant containers.
- Plant stock from other nurseries or harvested from external sites.
- Supplied soil.

Risk management for *Phytophthora* testing

It has become obvious that the current accreditation standard does not satisfy prominent clients involved in restoration of the conservation estate. Some of the main issues for nurseries that arise from requests for *Phytophthora* testing by clients are seen as follows.

To accept or refuse?

To accept *Phytophthora* testing leaves the nursery exposed should a positive result be returned. How would a nursery deal with such result? What could the impact be on the business? It can be expected to be anything from significant to devastating. Does the nursery have a plan for recovery after a positive result? Was a control sample retained by the nursery to enable verification of the result?

To refuse testing may raise suspicion and a test may still be undertaken independently by the client when stock is received. If positive, it is likely that payment for the stock would be in dispute. A refusal is likely to lead to the loss of future orders.

The reality is that testing is likely to become more prevalent in the future and the industry needs to accept that these risks need to be managed and systems established. Dealing with the issue in a proactive way is preferable to retrospective “fire fighting”. A positive test for *Phytophthora* is likely to have a debilitating effect on any nursery supplying the restoration/revegetation market.

Equity in maintaining nursery standards

It is preferable that testing by clients not take place at all as nurseries will not have sufficient control of the process, the outcome and the impact. The issue is to find a way to satisfy clients’ needs for appropriate hygiene standards and discourage independent client testing.

The only prospect of achieving this is by undertaking a comprehensive review of hygiene protocols, elevating them to a standard above accreditation, and implementing testing systems which are controlled by the nursery. The up scaled protocols can be detailed to customers, visitation encouraged and the nurseries policy regarding testing outlined and acceptance gained.

Recommended new nursery protocols for supply to conservation areas and for restoration and revegetation

The following protocols are proposed to address the risks associated with *Phytophthora* contamination of nursery plant stock for restoration and revegetation works:

1. All plant stock to be elevated off the ground at sufficient height to avoid root contact and water splash from ground surface.
2. All growing media batches to be tested to standards established by Murdoch University Centre for *Phytophthora* Research. Control samples to be retained by nursery.
3. All production to be tracked and matched to individual growing media batches to enable recovery action in event of positive test result. Growing media batches not to be mixed between batches.
4. No exposed ground areas within nursery (i.e. either hard stand or aggregate cover to depth of 100 mm).
5. No growing media to be recycled.
6. Plant stock must be bought from suppliers accredited under these protocols.
7. Recycling of containers to be a dual stage process, any two of chlorine solution inundation, steam sterilisation, commercial grade dishwasher hot wash for a minimum of 80 degrees C (solarisation, pressure cleaning and hand washing are not acceptable).
8. The following existing accreditation requirements continue to apply:
    a. All growing media and potting mixes to be sourced from accredited suppliers.
    b. Growing media mix to be housed within a clean and contained storage facility with no potential ground water inflow.
    c. All nursery water must be chlorinated.
    d. Clean-down stations and foot baths must be located at nursery entry points.
    e. Restricted vehicle entry and designated plant despatch area as a distinct hygiene area.
    f. Nursery tools and equipment to be exclusively for nursery use.
    g. A distinct quarantine area to be maintained for stock from outside sources.

Issues arising from proposed protocols

Cost

The significant cost associated with elevated metal benches is acknowledged. In some cases it may suit to utilise recycled plastic pallets to maintain stock ground clearance.

A quality 2 stage *Phytophthora* test will likely cost approximately $300 per test. In the Natural Area Nursery situation, the added cost per plant based upon an average year is 0.5 cents per tube.

The stage 1 test results would not normally be available for 2 weeks, hence the need for growing media batches not to be mixed and all production tracked relative to each batch. In the event of a positive test, this would allow subject stock to be isolated and dealt with.

Client acceptance

Proposed changes may not be acceptable to some clients and business decisions will be made within nursery management in dealing with each. However, it is the firm view at Natural Area that once in place, we do not intend to compromise the new arrangement by acceding to testing in the hands of others. Once stock has been accepted as in good condition and has left the nursery, the client may then carry out testing but the result of any test should not remove the client's obligation to pay for the stock. Should testing prove positive in this case, we would argue that we cannot be held responsible for stock out of our control.

Marketing

It is intended that Natural Area actively market the improved protocols as a positive initiative to the benefit of clients, the environment and the nursery industry in general.

Industry acceptance

There is no doubt that some, maybe many in the nursery industry will not accept that these proposed changes are necessary or in their interest to implement. However, having seen the impact elsewhere on *Phytophthora* introduction to a production nursery, the author has no doubt that the introduction of higher standards is very much a sound risk management exercise.

It is expected that the restoration and revegetation industry will establish design, operational and supply standards for projects and these are expected to include demanding standards on suppliers of seed and plant stock.

Implementation

We are currently road-testing the concept with clients in the lead up to the 2015 supply. The Directors of Natural Area Holdings/Natural Area Nursery expect to fully implement the improved protocols by end first quarter 2015. The author would appreciate constructive criticism and comment on the proposal from those involved in nursery and revegetation activity.

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Phenology and its contribution to understanding how plants adapt to a changing world

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Introduction

Phenology, a term first coined by Charles Morren Snr in 1849, is the study of the timing of key life-stages such as flowering and seeding in plants, or bird migration and fledging. It also involves examining the relationships between each of these stages and the influence of environmental factors such as climate on them (Leith 1974).

These stages, in turn, drive a wide range of processes at the community and population levels, at local and regional scales, and at ecological and evolutionary time scales (Dunlop and Brown 2008). They also influence many aspects that society values, such as food production, tourism and human health (van Vliet 2010). For example, hay fever is triggered by a phenological stage – the release of pollen.

Changes in the timing of phenological stages are also one of the first signals of a species being influenced by and adapting to a change in climate. This adaptation is probably indicative of phenotypic plasticity: the potential for a given genotype to be expressed differently in different environments.

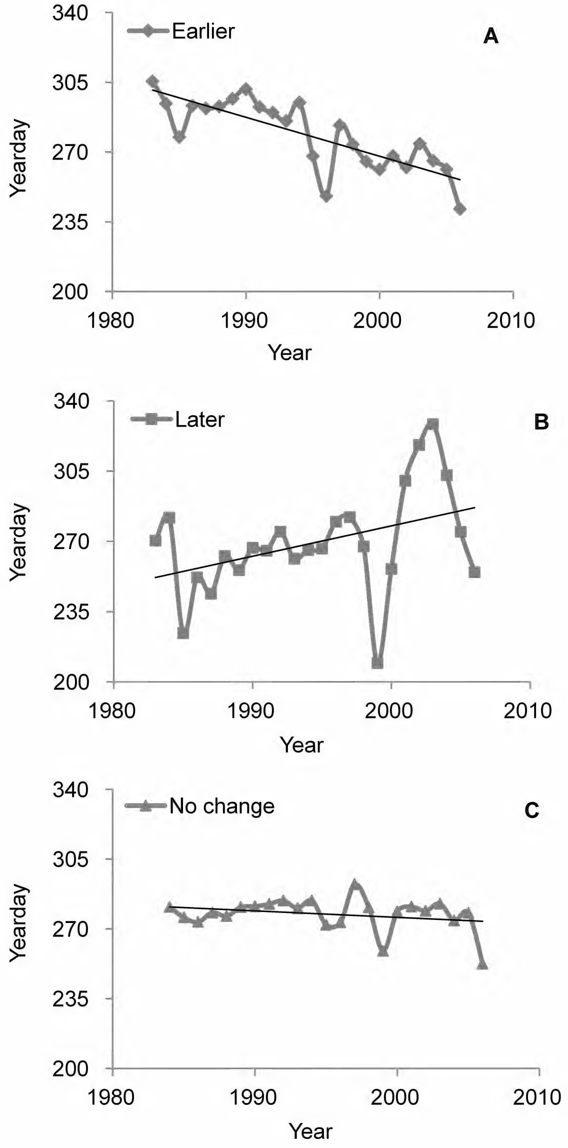
Each part of the reproductive cycle influences the preceding and succeeding stages: a bud becomes a flower which becomes a fruit which in turn produces seed. Weather influences the timing of each part of this cycle. Hence, each individual life-stage is a potential point for adaptation in a changing climate.

Historical Data

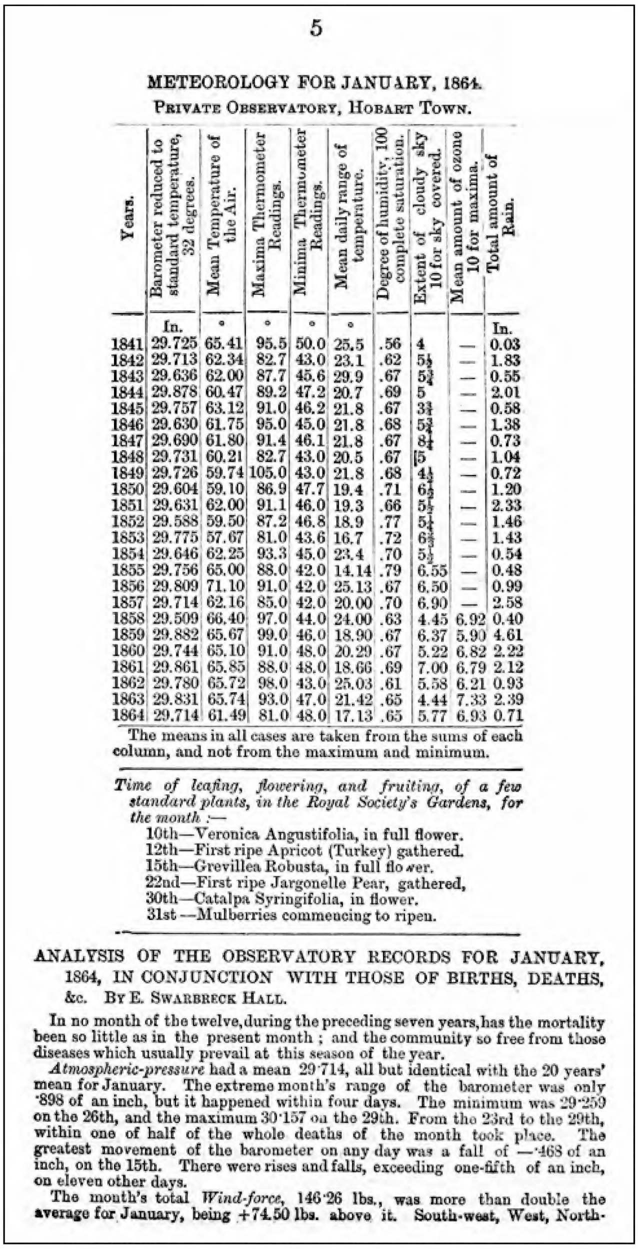
Long-term and historical data can provide a baseline against which current timing can be assessed. They also allow examination of which climate variable may have the most influence and therefore can be used to predict future changes in the timing of a particular life stage. Additionally, they easily illustrate if changes have occurred and, if long enough, at what point in time the change is most likely to have occurred.

A recent example (1983 to 2006) uses the observations of first flowering dates of 65 lowland forest, understorey species in Victoria. Of the 65 species, 13 seem to be adapting: eight flowered from 0.7–3.3 days per year earlier, five species flowered 1.0–2.9 days per year later, while 52 did not change significantly.

One of the earliest Australian examples of historical phenological data is provided by The Royal Society of Tasmania. The Society recorded the leafing, flowering and fruiting dates of plants in the Royal Tasmanian Botanical Gardens between 1864 and 1885. Examination of the records has found that that 53% of the 48 species have at least one life stage driven by changes in rainfall, minimum temperature, or both.



First flowering dates (expressed as Yearday, where 1st January is 1 and 31st December is 365) in understory plants at Beaconsfield, Victoria between 1983 and 2006; (A) average of the eight earlier flowering species, (B) average of the five later flowering species, and (C) average of the 52 species whose first flowering date did not change.



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METEOROLOGY FOR JANUARY, 1864.

PRIVATE OBSERVATORY, HOBART TOWN.

Years.	Barometer reduced to standard temperature, 32 degrees.	Mean Temperature of the Air.	Maxima Thermometer Readings.	Minima Thermometer Readings.	Mean daily range of temperature.	Degree of humidity, 100 complete saturation.	Extent of cloudy sky 10 for sky covered.	Mean amount of ozone 10 for maxima.	Total amount of Rain.
	In.	°	°	°	°				In.
1841	29.725	65.41	95.5	50.0	25.5	.56	4	—	0.03
1842	29.713	62.34	82.7	43.0	23.1	.62	5½	—	1.83
1843	29.636	62.00	87.7	45.6	29.9	.67	5¾	—	0.55
1844	29.878	60.47	89.2	47.2	20.7	.69	5	—	2.01
1845	29.757	63.12	91.0	46.2	21.8	.67	3¾	—	0.58
1846	29.630	61.75	95.0	45.0	21.8	.68	5¾	—	1.38
1847	29.690	61.80	91.4	46.1	21.8	.67	8¼	—	0.73
1848	29.731	60.21	82.7	43.0	20.5	.67	[5	—	1.04
1849	29.726	59.74	105.0	43.0	21.8	.68	4½	—	0.72
1850	29.604	59.10	86.9	47.7	19.4	.71	6½	—	1.20
1851	29.631	62.00	91.1	46.0	19.3	.66	5½	—	2.33
1852	29.588	59.50	87.2	46.8	18.9	.77	5¼	—	1.46
1853	29.775	57.67	81.0	43.6	16.7	.72	6⅓	—	1.43
1854	29.646	62.25	93.3	45.0	23.4	.70	5½	—	0.54
1855	29.756	65.00	88.0	42.0	14.14	.79	6.55	—	0.48
1856	29.809	71.10	91.0	42.0	25.13	.67	6.50	—	0.99
1857	29.714	62.16	85.0	42.0	20.00	.70	6.90	—	2.58
1858	29.509	66.40	97.0	44.0	24.00	.63	4.45	6.92	0.40
1859	29.882	65.67	99.0	46.0	18.90	.67	6.37	5.90	4.61
1860	29.744	65.10	91.0	48.0	20.29	.67	5.22	6.82	2.22
1861	29.861	65.85	88.0	48.0	18.66	.69	7.00	6.79	2.12
1862	29.780	65.72	98.0	43.0	25.03	.61	5.58	6.21	0.93
1863	29.831	65.74	93.0	47.0	21.42	.65	4.44	7.33	2.39
1864	29.714	61.49	81.0	48.0	17.13	.65	5.77	6.93	0.71

The means in all cases are taken from the sums of each column, and not from the maximum and minimum.

Time of leafing, flowering, and fruiting, of a few standard plants, in the Royal Society's Gardens, for the month :—

10th—Veronica Angustifolia, in full flower.
12th—First ripe Apricot (Turkey) gathered.
15th—Grevillea Robusta, in full flower.
22nd—First ripe Jargonelle Pear, gathered,
30th—Catalpa Syringifolia, in flower.
31st —Mulberries commencing to ripen.

ANALYSIS OF THE OBSERVATORY RECORDS FOR JANUARY, 1864, IN CONJUNCTION WITH THOSE OF BIRTHS, DEATHS, &c. BY E. SWARBRECK HALL.

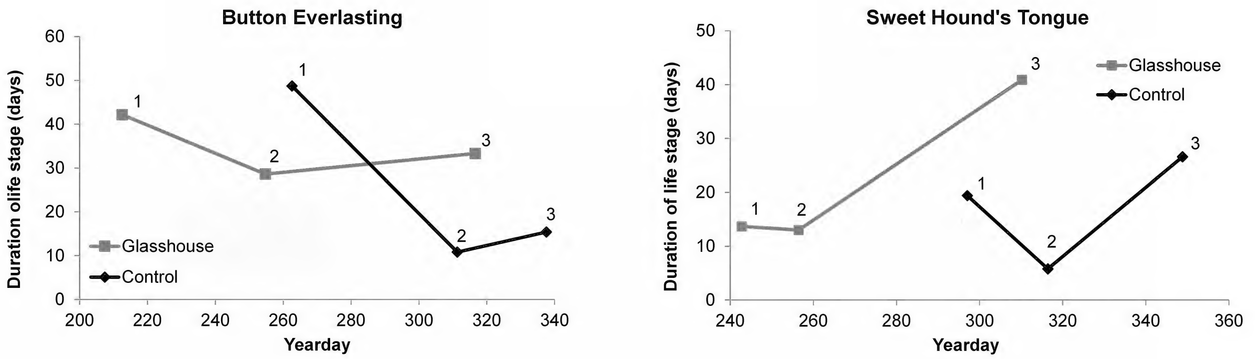
In no month of the twelve, during the preceding seven years, has the mortality been so little as in the present month ; and the community so free from those diseases which usually prevail at this season of the year.

Atmospheric-pressure had a mean 29·714, all but identical with the 20 years' mean for January. The extreme month's range of the barometer was only ·898 of an inch, but it happened within four days. The minimum was 29·259 on the 26th, and the maximum 30·157 on the 29th. From the 23rd to the 29th, within one of half of the whole deaths of the month took place. The greatest movement of the barometer on any day was a fall of —·468 of an inch, on the 15th. There were rises and falls, exceeding one-fifth of an inch, on eleven other days.

The month's total *Wind-force*, 146·26 lbs., was more than double the average for January, being +74.50 lbs. above it. South-west, West, North-

Excerpt from the Proceedings of the Royal Society which lists some of the species and their phenological stage for January 1864.

Another example is the budding and flowering records of eucalypts recorded by Victorian Forest Officers from about 1930 until approximately 1981. As these records provide information on a monthly basis they enable the flowering pattern to be established. For example, Red Ironbark (*Eucalyptus tricarpa*) does not flower every year. At one location, Rushworth, Victoria, it missed flowering four out of 25 years between 1945 and 1970. This is much less often than recently documented, when it did not flower 4 out of 11 years between 1997 and 2007 (including 3 times between 2002 and 2007). This reduction in flowering is believed to have contributed to a severe regional decline in nectar-dependent birds (Mac Nally et al. 2009).



Mean duration and mean yearday of three phonological stages of Button Everlasting and Sweet Hound's Tongue in both glasshouse and control environment. 1 = mean date bud visible, 2 = mean date first flowering, 3 = mean date mature seed.

Experimental Data

Experimental evidence further aids our understanding (e.g. identifying which climate variables are most influencing a given life stage) and can help tease apart whether the adaptation that is occurring is phenotypic, genetic or a combination.

These studies, however, are usually focussed on individual stages. Studies which examine more than one stage help in understanding how changes in timing of one stage might influence another. Nugent et al. (2014) grew Button Everlasting (*Coronidium scorpioides*) and Sweet Hound's Tongue (*Cynoglossum suaveolens*) in both a control (outside) environment and a glasshouse (on average 5.6°C warmer than the control). Plants were watered every 1–3 days to standardise any soil moisture interactions with the stage. Each of four life-stages – first bud visible, first and last flowering, seed dispersal – occurred earlier (20.9–60.0 days) in the warmer environment. The duration of stages was also longer in the warmed environment except for budding to first flowering.

Interestingly, for both species timing of first flowering showed the largest differences between the control and glasshouse treatment, followed by the first bud appearance, the end of flowering and lastly presence of mature seed. Therefore, in these two species at least, differences in one stage were not clearly evident in another. However, the large shifts in each stage demonstrate both species display a high degree of phenotypic plasticity in their reproductive phenology, potentially allowing greater adaptability to elevated temperature. It was also interesting to note the plants grown in the warmer environment were taller and produced larger seeds.

Conclusion

Changes in the timing or duration of plant life-stages can alter vegetative and reproductive output, potentially changing the distribution and abundance of individual species, and hence the composition of plant communities. This can in turn alter the quantity and distribution of resources such as nectar and pollen, impacting on the faunal species that depend on these resources. Phenological studies – whether using historical records or experimental data – can improve understanding of climatic influences on plant life-stages. Historical records provide a baseline against which current behaviour can be compared, and from which prediction of changes in response to future climate can be made. Experimental studies can tease apart the influences of climate on individual species. Phenology thus provides a vital tool in understanding and predicting plant community responses to a changing climate.

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Plenary Lecture: *Engagement and Communication in the Modern World* subtheme

Communicating, connecting, inspiring, acting in the modern world

Andrew Smith

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Flooded with information, right there on our screens. But is all that information worth anything if there is no passion to utilise it? Does it mean anything without a context? It seems that today we have so many ways to communicate with people, instantly, where they are. There is a mountain of information at our fingertips. Does this make us more connected or less connected when it comes to nature, conservation, threatened species and plants?

While it is true that all things in the world can be divided into two categories – things that are icecream, and things that are not icecream – it is not true that the world can be divided into those who agree with me and those who are wrong. In reality there are many solutions to any problem and the more we include different points of view the more likely we will find one that works well, and the more likely we will be able to implement it. This support, commitment and capacity are critically important to plant conservation.

We are living in an age of conservation reliance. We have disrupted things so much that nature cannot possibly stand on its own anymore. Endangered species are only going to survive if we stay out there rigging the world around them in their favour. We are now micromanaging the survival of species indefinitely, but which ones?

This grim reality has inspired some amazing conservation measures. Field botanist Kenneth Wood of Hawai'i's National Tropical Botanical Garden is renowned for abseiling down vertical cliffs to replace lost bird pollinators by hand-pollinating endangered plants clinging to existence out of the reach of feral goats, pigs and cattle. In some cases the resultant seeds were propagated, and planted back into areas where pollinating birds still existed, thereby re-establishing ancient natural processes and relationships. In the case of the Kokia tree, survival requires hand-pollinating every season, forever. The Kokia's specific pollinator – a honey creeper with a long curved beak that fitted snugly into the large red flowers of the tree – is now only known from museum specimens, having gone extinct in the 1800s. The continued survival of the Kokia is directly linked to the continuing passion that drives the scientists involved in that program.

There has been a lot of talk recently about scientifically triaging species to determine government funding priorities. In reality the species that survive will be those that we as a community have decided deserve to stick around, and those people want to actively contribute towards saving.

Smith (2014) recently discussed the demise of species and the call to triage recovery efforts, asking which species should make it onto a metaphorical ark? Which species do we choose to save and which do we leave behind? Smith describes the case of the Tasmanian Devil, whose existence is under immense threat from devil facial tumour disease, and whose existence would appear to be dependent on an army of scientists racing to finding a cure. Smith concludes the article by describing a very personal experience holding a baby Tasmanian Devil in her arms while it waits to be bottle fed, and it is in that moment of connection that the species secures its place on the ark.

The stories that we tell about nature need to be subjective, from the heart and aimed at the heart, personal, relating directly to those we are talking to, so the stories may at times seem irrational and romanticised and sensationalised. Sometimes they might simply have nothing to do with the facts. But those stories have very real consequences, because now, how we feel about nature affects its survival more than anything that you read about in ecology textbooks. Storytelling matters now. Emotions matter. Experiences matter. Imagination is an ecological force.

I once knew a great plant conservationist, the now late Dr David Given, who travelled the world promoting and assisting with plant conservation, and a great friend of the ANPC. We dubbed him 'celmisia-man', because of his infatuation with *Celmisia* species. David had managed to see them all, except for one species found in the Tasmanian highlands. It was of critical importance that he see this plant in the wild (in books, pressed in herbariums and on the web didn't cut it), so we traipsed up to the Tarn Shelf in Mt Field National Park, on a day of horizontal rain, freezing temperature and thick fog to go celmisia hunting. Eventually we found one close by the track

– a tiny, insignificant button of a plant – yet so dear to David that he spent many minutes laying on his stomach, on saturated ground, gazing at the plant, getting to know it before taking a photo of his final *Celmisia* species, having now personally met every last one of them.

What drives and inspires people like Dr David Given to develop such passion and love for plants?

Some time ago at an International Botanic Gardens Conference, I led a session with educators, scientists and managers who wanted to work out how to get children interested in plants. The group struggled with a lot of "they need to know ... they need to understand ... we have to tell..." statements. When asked what it was that made those in the room commit their working life to plants and plant conservation, almost universally the answers involved childhood memories of time in nature, walks, camps, fishing, hiding, collecting, playing and building dams and forts. Special moments in nature. As children they were engaged with the natural world, immersed in that world, most often without lesson plans, without instruction, without supervision. That immersion inspired love, curiosity, creativity, a need to understand, a desire to be involved, a care and concern and a desire to give back to the natural world.

So if we want people to be plant conservationists and to value plant species and communities, if we want them to care enough to act, we need to engage them in experiences that ensure connections and relationships are developed with the natural world. This isn't about chalk and talk, or walk, point and talk, or thousands of statistics sitting unvisited in databases. It is about spending time, involving, participating, experiencing, sharing, developing love, engaging hearts, heads and hands. It's what switches on their curiosity, wanting to understand more about what is around them. Unfortunately, tadpole hunting and swinging from trees is becoming less popular with parents who judge outdoor activities dangerous rather than educational.

Worryingly, the number of hours that people spend outdoors is declining, for both adults and children. We are instead spending more time in front of screens – for children as much as eight hours a day. For adults, even more. Despite its capacity to deliver millions of words of information and facts, despite having a Facebook post or a YouTube clip for everything, the internet may well be a major contributor to *disconnecting* people from experiencing nature first hand. People who do not experience nature first-hand, no longer know nature and therefore don't care about nature.

Balmford et al. (2002) of the University of Cambridge, asked a group of children to identify both actual species in nature and fictional Pokémon characters, using a series of flash cards with images of the real and imaginary "creatures." Children aged 8 and older typically identified Pokémon 'species' substantially better than organisms such as oak trees or badgers. The study concluded first that young people have tremendous capacity for learning about creatures (whether natural or man-made), being able to identify nearly 80% of the sample drawn from 150 synthetic 'species.' The second conclusion was that "conservationists are doing less well than the creators of Pokémon at inspiring interest in their subjects". It may serve the planet well to make sure that for children, first-hand exposure to nature outweighs the exposure to screen-based experiences.

When you give people a chance to be involved with what they love that you will be totally amazed at what can be achieved in the real world. It is love that brings volunteers in their hundreds to nature conservation and reserve management. High levels of volunteering is a sign of a strong supportive community and society that is engaged with a cause, an interest, a place and each other. It is not a response to a diminishing economy or reducing budgets. The primary community volunteer partner organisation to the Tasmania Parks and Wildlife Service – Wildcare Inc (www.wildcaretas.org.au) – has 6000 members who provide more than $6 million worth of time annually to a wide variety of reserve management, nature conservation and cultural heritage conservation projects.

Volunteers are inspired by their passions and love of nature, of particular places, of wildlife, including plants. They give back to nature. They roll up their sleeves and work hard. Volunteers are engaged and brilliant. Engaged people glue our world together and make it work properly. People out in the real world, side by side, sharing passion, experiences and effort, will be what shapes the world we hand on to future generations.

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Sacred values and filthy lucre – taboo trade-offs in conservation. A perspective on the triage debate

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The imperative to secure threatened species is a 'sacred' duty for those with a conservation ethic. Advocates of triage implore us to consider this duty alongside the monetary costs of management intervention, because any decision to allocate resources to one activity forgoes the opportunity to allocate those same resources elsewhere. Implicit in the decision is a trade-off between what is anticipated to be gained (or lost) and what could have been gained (or lost).

Although such decisions are made routinely by individuals and organisations, we rarely formalise our thinking in a way that makes opportunity costs apparent. To do so invites the possibility of disappointment and regret. But when the stakes are high and the decision complex, failure to do so can lead to very poor outcomes.

In conservation management, trade-offs involving 'sacred' values and monetary cost are unpalatable. Tetlock et al. (2000) describe a sacred value as 'any value that a moral community implicitly or explicitly treats as possessing infinite or transcendental significance that precludes comparisons, trade-offs, or indeed any other mingling with bounded or secular values'.

Psychologists have a typology for value judgments that includes routine, tragic and taboo trade-offs. Routine trade-offs involve two secular (or non-sacred) values, for example, fuel efficiency and comfort in the purchase of a car. Routine trade-offs can be cognitively challenging, but their emotional demands are modest. Tragic trade-offs involve two sacred values. The judgment of the extent to which an advantage to one threatened species compensates for a disadvantage to another in a decision involving ecological burning is an example. Tragic trade-offs are difficult, but people understand the need to make them and will engage them thoughtfully. Taboo trade-offs are those involving a sacred value and a secular value. The monetary savings (or outlays) required to compensate specified disadvantage (or advantage) to a threatened species is a glaring example.

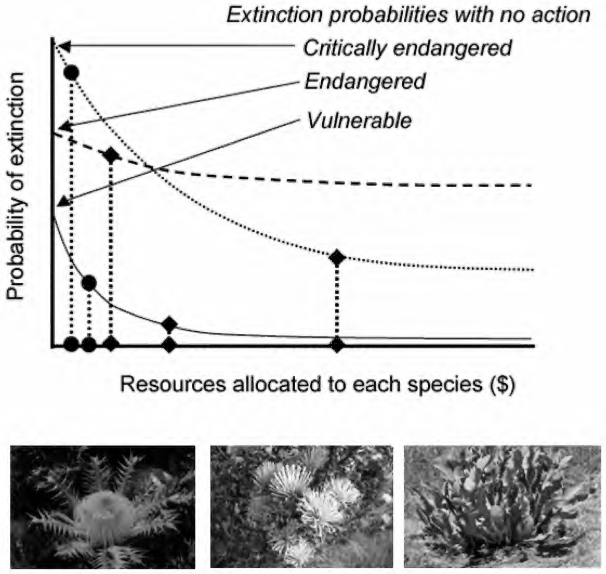
Taboo trade-offs leave us feeling grubby, or at least vaguely compromised, and so we tend to go out of our way to avoid the internal conflict they incite. Alongside flat out refusal to participate, avoidance strategies include 'buckpassing, procrastination, and obfuscation to escape responsibility for making trade-offs that inevitably leave some constituency feeling it has gotten the short end of the trade-off stick' (Tetlock 2000).

Direct treatment of the triage trade-off demands we articulate how much should be spent on threatened species, individually and collectively. This is an important social question, but one we are hopelessly ill-equipped to answer in operational day-to-day management settings. A common avoidance strategy is to resist a considered response to the question of willingness to pay and instead provide loose judgments that deny the realities of constrained resources. This avoidance strategy is evident in the perception that taboo trade-offs are 'easy', whereby decision-makers fallback to a simple heuristic assigning precedence to the sacred value no matter what the cost (Lichtenstein et al. 2007). In conservation, this inclination leads to a bottomless bucket mentality in the management of a few highly visible species, and chronic under-allocation to the many others whose precarious existence is veiled by our distaste for taboo trade-offs.

Many managers are more inclined to place greater value on extending the life of a critically endangered species rather than a vulnerable species. This inclination may stem from a perceived moral imperative to 'save' those taxa at greater and more immediate peril. But where more cost effective actions are available for species further from the precipice of extinction, the downside of this impulse is that it leads to a greater species loss over the long run, assuming no dramatic increase in the availability of resources over time (Wilson et al. 2011).

Given the challenges of eliciting sober judgments for taboo trade-offs, it may be better to treat them in a way that doesn't place unreasonable demands on decision-makers (Gregory 2002). To deal indirectly with taboo trade-offs we suggest candidate management actions for multiple species be assessed according to their cost-effectiveness.

Weitzman (1998) proposed ranking each candidate action according to its cost-effectiveness, $\Delta p/c$, whereby benefit was characterised as the change in species persistence Δp with implementation of the action, and cost c was the monetary outlay required for implementation. For a finite budget, the greatest cumulative benefit over multiple actions is achieved through selecting the most cost-efficient actions until the budget is exhausted.



CR *Banksia anatona.* Source: ANPC

EN *Banksia cuneata.* Source: ANPC

VU *Banksia goodii.* Photographer: Geoffrey Watton

Hypothetical pay-off curves illustrating the optimal allocation of resources for three equally valued species under a small budget (circles) and larger budget (diamonds). Cost effectiveness is the slope of the curves. Adapted from Possingham et al. (2002).

The advantage of cost-efficiency calculations as a guide to decision-making is that they make direct treatment of taboo trade-offs involving monetary cost unnecessary. For any bright (or not so bright) idea for treating extinction risk, we simply make estimates of the benefits to species persistence and the costs of implementation, then use the calculation of cost-effectiveness to guide our allocation. For fixed budget problems it can be used to identify the optimal allocation of resources, at least for those candidate actions considered in the decision problem.

The 'triage' debate in conservation mirrors arguments advanced in the allocation of public health resources, where the notion of quality-adjusted life years (QALY) is used to characterise the benefit of candidate medical interventions in cost effectiveness assessments. Peter Singer, moral philosopher at Princeton University, wrote in a 2009 piece for the New York Times, 'QALY is not a perfect measure of the good obtained by health care, but its defenders can support it in the same way that Winston Churchill defended democracy as a form of government: it is the worst method of allocating health care, except for all the others.' Until we're able to embrace the challenges of taboo trade-offs more meaningfully, simple calculations of cost-effectiveness are our best guide for allocating conservation resources.

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Considerations for large-scale biodiversity reforestation plantings. Part 3: implementation phase

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Introduction

This article is the third in a series discussing considerations needed in large-scale tree planting for biodiversity outcomes. After the planning phase is complete with approvals for the large-scale reforestation project to continue, implementation can proceed. This article is presented in the context of native tube planting projects in post-agricultural landscapes in temperate to subtropical zones on the east coast of Australia.

Plant procurement

Plant procurement timeframes are critical to project implementation. Generally, there will not be enough plant material available at any one time for large-scale plantings. Insufficient plant supply may delay implementation, which may have implications on achieving milestones and associated payments. To be certain of supply and species diversity 'pre-ordering' is essential. Contract growing will be covered in a forthcoming governance and project management article, to be published in a future issue.

Preliminary works – site establishment

Prior to any on ground works, risks and hazards need to be identified and treatments determined. This process will be covered in a future edition.

Procurement of materials (e.g. fertilizer, fencing, stakes) must be completed and materials freighted to site so that site establishment can commence. Delivery, storage and wash down areas are to be determined. A suitable location for a holding nursery must be nominated for ease of deliveries at the planting stage – ideally this could be located near a water supply in close proximity to the planting zones.

External access tracks, fire breaks and infrastructure set-backs (e.g. powerline easements) should be marked on the ground. Access tracks are determined from the design and can be refined and allocated on-site based on topography to ensure as much all-weather access as possible.

Protection of existing native vegetation should be undertaken, including fencing off exclusion zones for remnant vegetation, habitat areas, and significant trees. Natural recruitment which can complement tree planting must be identified and protected prior to site preparation activities such as slashing.

Site works must not cause soil exposure that may increase the risk of erosion. If cultivation or amelioration is to be undertaken (e.g. ripping planting rows) then the contractor is responsible for implementing all necessary procedures and controls to prevent erosion and sedimentation in nearby waterways. In general minimal cultivation techniques are preferred, since cultivation can facilitate weed establishment, increasing maintenance costs.

Site preparation

Slashing

Large-scale reforestation projects will often be implemented on cleared and degraded agricultural landscapes where pastoral grasses and exotic weeds form the groundcover. Slashing of exotic grass several times is generally necessary so that the planting areas can be set-out. In areas where exotic grass has the same function as native grass for bird habitat, these areas can be excluded or slashed in rotation or as a mosaic to minimize habitat impacts.

Weed management

'Initial' and 'secondary' weed treatments will be required during this initial establishment phase. Initial weed treatment may include eradicating *Lantana* or other woody weeds to maximize areas available for planting. Secondary treatment involves using herbicide to target the new growth on woody weeds along with any exotic grasses and vines that may threaten new plantings. As weed populations have often existed on a site for decades they may persist after preliminary treatments and require ongoing management within the post-planting maintenance regime.

Site design and management zone layout

Next, management zones and planting areas need to be set-out, transferring the design from maps on to the ground through GPS points and staking. The set-out will define the boundaries of each zone including internal access tracks.

It is at this stage that the planting densities nominated in the planning phase are established. For instance, 1000 stems per hectare translates as 3 m between planted rows and 3 m between trees along rows. Setting out plant spacing will ensure efficiencies with the actual planting. The average 3 m distance between each row allows access for water trucks, tractors, slashers and maintenance vehicles.

Soil cultivation and amelioration

The need for cultivation and amelioration (supplementation of soil with e.g. lime, gypsum or compost to improve quality and productivity) will be informed by the results of soil investigations, groundcover type and site design (e.g. planting in rows on the contours or infill planting). Ripping in rows can improve soil structure where compaction has occurred from past land use and enable amelioration, if required, to increase fertility. For instance, in compacted clay soils liquid gypsum may be prescribed as part of the planting methodology and applied to each planting hole or row with sufficient time to be effective.

Mechanical cultivation and mulching in rows at Wacol, QLD. Photo: Dan Cole.

Chemical treatment – management zones

If there is no cultivation, herbicide spraying of individual planting circles or entire planting rows needs to occur to reduce the likelihood of new plants being overgrown by grass. Spraying is based on the specified densities for each management zone.

Spraying individual planting circles is generally a preferred and efficient method for minimal cultivation techniques such as hand-planting which maximises groundcover retention. Spraying entire rows is another appropriate method particularly if mulch can be later applied. This method does use more chemicals and without mulch exposes soil to potential erosion and possible ‘cracking’ during extended dry periods.

Mulch

It is often considered too expensive to import a mulch product on large-scale reforestation projects. However, slashing of inter-rows can provide a substantial amount of trash that can be placed around each tree as an effective mulch layer substitute.

Planting

Holding nursery

Once freighted to site, plants require storage in a holding nursery. The order must be checked for quality, correct species and quantities, and any damage from transport. Signing the delivery docket will typically form the last claim for any rejections and replacements. The plants should be watered and then allocated to each management zone. Prior to planting trays of tube stock can be soaked in water and liquid seaweed extract (or similar stress reducers) to ensure the root zone is saturated and minimise transplant stress.

Planting techniques: manual or mechanical?

One of the greatest challenges of large-scale biodiversity reforestation is the actual planting. This is because it can be difficult to resource or contract a trained team that can work at a large scale; traversing large areas, managing a mix of species and working quickly while retaining planting quality.

There are a variety of methods available for planting and decisions can be based on the scale of the project and associated budgets. Mechanical planting has been adopted by the industrial, monoculture, forestry sector. This method can minimise labour inputs although there can be complications managing mixed species (i.e. not just eucalypts or pines). Motorised augers can be effective for opening up compacted soil although they can polish and glaze the planting holes, restricting root penetration and therefore establishment rates. Hand-planting can deliver the best establishment outcomes, although it is labour-intensive and achieving high production targets is difficult.

Planting matrix

It’s important as part of the mapping or drawing package that there is an indicative planting matrix for each management zone and that these are provided to the planting contractor. The matrix needs to indicate the proportion of primary canopy, sub-canopy and understorey species to be planted, including the distribution of pioneer species to achieve the canopy framework representative of the regional ecosystem to be reinstated.

Site design maximizes access in a Phase 1 planting. Photo: Dan Cole.

Successful mixed species establishment at Griffith University, Environmental Arboretum, Logan campus, QLD. Photo: Anna Markula.

Planting quality

Planting inspections should occur at regular intervals, noting densities and species mixes along with checking the application of fertiliser and moisture retention medium, if specified. Quality planting can minimise mortality and plant survival is often nominated as a percentage in the technical specification that can be linked to a milestone payment and/or contract hold point.

Watering and tree protection will be covered in a future article focusing on maintenance.

Concluding summary

Implementing large-scale biodiverse reforestation projects requires a combination of professional skills in the fields of ecological restoration, silviculture, horticulture, land management and project management. Contractors need to be multi-disciplined, pro-active and well resourced. In the next issue we examine maintenance of large-scale projects.

ANPC member profile

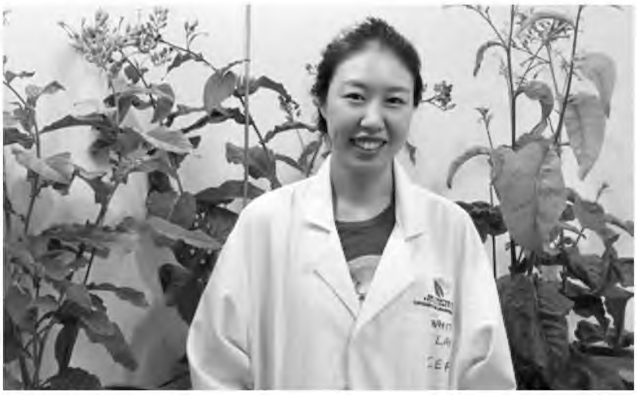
Yileen Lim

What is your current role?

It has been almost five years since I enrolled as an international student at the Australian National University in Canberra for a postgraduate PhD in Plant Science. The study of Plant Science includes (but is not exclusive to) the subject of plant gene expression, drought and disease resistance, and the understanding and improvement of photosynthesis. I started my student program in 2010 and will be submitting my thesis in early May.

What research project are you working on at the moment?

I am part of a great team of scientists and students at ANU that focuses on RuBisCO – a protein that is a key enzyme in photosynthesis. Our study of RuBisCO is part of a global initiative to improve photosynthesis in crops, and therefore increasing yield and resource use efficiency. Our research is funded by the Bill and Melinda Gates Foundation as well as the Australian Research Council. My contribution to the group is research into the subunit synthesis and assembly of RuBisCO in plants as well as novel methods in bioengineering the enzyme using tobacco as a model crop plant.



How did you end up working in plant science?

My interest in protein biochemistry began after completing a few courses in protein biotechnology during my undergraduate years at the University of Waikato (New Zealand) whilst undertaking an engineering degree. The influences of molecular charge, size and structure of the proteins that make up life on Earth intrigued me and later led to my decision to do a PhD on the subject of proteins and enzymes. Whilst doing an undergraduate internship, I was unfortunate enough to open a freezer containing dead laboratory rats. I have never recovered from that experience, and since then decided to work only with plant material for the rest of my duration in science!

Are you involved in any volunteer activities?

Recent progress with my thesis has granted me the luxury of volunteering at the ANPC office. Prior to this, my research was intensive in terms of working hours and time-based experiments. I am looking forward to more voluntary opportunities soon after my submission as my experience with the ANPC has been very rewarding.

How has the ANPC benefited you?

The ANPC has provided me with increased knowledge of Australian plants and the effort it takes to sustain and rehabilitate native vegetation. I also have a lot more appreciation for the work done by non-profit organisations, and the effort that goes into community outreach and fund-sourcing. Being involved with conservation work has definitely given me a lot of insight into what I can do for my own country (Malaysia). We are very behind in environmental and conservation work compared to Australia, with Greenpeace Malaysia only established in 2014. Given the opportunity, I would love to learn more about how developed countries such as Australia implement their conservation strategies. My learning experience with the ANPC will be useful when volunteering for organisations that protect and sustain the tropical rainforests and native flora of Malaysia.

What are your future plans?

I have thoroughly enjoyed the logic of science and nitty-gritty laboratory work over the past few years. However having said that, I am inclined to take a few months break from science to instead develop my interest in photography, language learning, working for non-profit organisations, and website design. I also have plans to stay in Australia after graduation, and so will be looking for job opportunities either related to my areas of interest or to the skills I have developed during my PhD.

Projects in focus

Bring Back the Banksias

Martin Driver, ANPC Project Manager

Throughout south-western NSW and across Victoria, Silver Banksia (*Banksia marginata*) has mostly disappeared from the landscape over most agricultural areas. This loss of the original plant populations has occurred due to grazing by domestic and feral animals, direct damage from rabbits, destruction of rabbit warrens, and wildfire.

The ANPC has joined forces with an extensive network of agencies, groups and individuals concerned about the conservation of Silver Banksia in these areas, and a collective of projects and groups has been forged under the title of 'Bring Back the Banksias'. The aim is to bring people together to identify known sites and populations of Silver Banksia, and participate in developing a network of seed production areas for future revegetation projects. Three workshops have been held to date in Hamilton, Bendigo and Lake Bolac with over ninety participants and a huge response from others wanting to be involved in the project as it evolves.

The ANPC has brought these interests together with a view to avoid duplication, assist with communications and networking, and seek information on the latest science in conservation efforts for Banksias. It is hoped that addressing funding, research and extension in a more coordinated way will ultimately bring about a sustainable conservation outcome for the species and its habitats over a wider area than the current fragmented approach.

Initially the geographic scope of the project will cover the Mallee/ Wimmera, Central, North Central, Goulburn Broken, and North East Victorian CMA regions (including the Victorian Volcanic Plains program in Glenelg Hopkins CMA) and the Murray Local Land Services region in NSW. It may expand to other regions at a later date subject to interest and resourcing. Initially it is intended to cover the tree form of Silver Banksia only.

Initial objectives of the project group are to:

- Establish some resourcing to service the initial process, required workshops and network communications costs etc.
- Initiate data collection to map and collate known past and current Silver Banksia populations.
- Procure funding to initiate a genetics project.
- Co-ordinate a genetic audit of the Silver Banksia population range to inform restoration strategies.

Projects in focus (cont.)

Longer term and concurrent objectives are to:

- Maintain email communications with all interested parties and support networking opportunities.
- Identify and collate ecological and management issues and barriers for Silver Banksia restoration projects – establish needs and required support.
- Establish process and funding for seed collection and Seed Production Areas (SPAs) for future restoration.
- Establish support process and funding for a network of Silver Banksia remnant enhancement and restorations sites.

Funding support is in the very early stages of development and future awareness and support of program ideas are in discussion. Anyone who is interested in the conservation of Silver Banksia who would like to support or join in these efforts should make contact with Martin Driver, ANPC Project Manager, on phone 0400170957 or email at projects@anpc.asn.au. Look out for future project updates at anpc.asn.au/banksias

Participants at the Bendigo Bring Back the Banksias workshop. Photo:Martin Driver

Book reviews

A Guide to Southern Temperate Seagrasses

by Michelle Waycott, Kathryn McMahon and Paul Lavery

CSIRO Publishing, 2014
112 pages with colour photographs and line art
Paperback, ISBN: 9781486300150

I have treated this highly informative book as a guide, with the intention of the writers that it be used primarily by non-botanists to identify non-algal plants that are found along the beach or caught in hooks while fishing or just swimming or wandering about in southern temperate coastal regions, covered on page 26.

The book is also an important contribution to greater knowledge of the value of these plants as stabilizers and habitat for other organisms. It is timely, as generally the shallow coastal zone has been seriously degraded, with sea grasses amongst the first to be lost.

The section arrangement covering Habitats, Ecology, Taxonomy Fauna, Reproduction and Evolution are written to inform the non-scientist of the complexity of this plant group. These pages are brief and informative.

The term “complex” for *Posidonia*, *Zopstera* and *Halophila* is probably appropriate given that various botanists have for some time flagged uncertainty when it comes to naming these plants.

References are not used, but a bibliography is given for further reading.

The families Ruppiacceae (*Ruppia* spp.) and Potamogetonaceae (*Lepilaena* spp.) have received limited treatment on the basis that they do not fit into this guide.

One small point. This small book will be used in the field and the page numbers are very small, making its use in the field difficult for some.

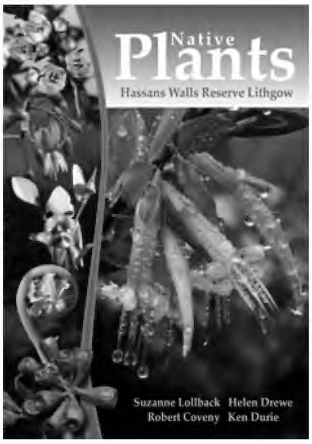
Geoff Sainty, Sainty and Associates

Book reviews (cont.)

Native Plants Hassans Walls Reserve Lithgow

by Suzanne Lollback, Helen Drewe,
Robert Coveny and Ken Durie

Lithgow and District Community Nursery, July 2014
161 pages with colour photos. Ringwire-bound A5. ISBN 978-0-646-92309-3
Price: AUD20.00 + AUD4.00 per unit post and handling
Available from Lithgow & District Community Nursery, PO Box 492, Lithgow NSW 2790, or email suzaloll2@bigpond.com



Two years ago, the Lithgow & District Community Nursery group produced a nifty little field guide, briefly reviewed in these pages, on the orchids of Hassans Walls Reserve near Lithgow on the western edge of NSW's Blue Mountains. Diligent fieldwork by the group had uncovered an amazing 62 species in a reserve of less than 800 hectares – which must be one of the highest concentrations of terrestrial orchid taxa recorded in Australia.

Two years on, and there are three bits of good news. The orchid book sold out; the orchid count in the reserve is now up to 73; and the same group have produced another excellent field guide, this time documenting the *whole* flora of the reserve (well, most of it ... their fungi count is over 250, not all identified, and only 28 are included in this book).

Produced in a compact format, the new book presents images of 359 species of flowering plants, 20 ferns, 18 bryophytes, and 41 lichens and fungi. The colour photos are mostly excellent and good-sized, and many have insets of features to aid identification. The text is minimal, with scientific and common names, brief descriptive info, habitat, local frequency and flowering time. 'Wildflower' species are presented in flower colour groups and within these alphabetically by genus. Other groups have their own sections: eucalypts, orchids, grasses and sedges, non-vascular plants and fungi. A further 97 native plants recorded for the reserve are listed, as are 92 native and exotic introductions. Brief illustrated profiles are provided of the ecological communities.

Aren't there enough Blue Mountains field guides already? Well, perhaps yes (for the main plateaux and down to the eastern escarpment, although few are as comprehensive or as well-illustrated as this one) and no (for the western fall of the Blue Mountains, including the Lithgow area). There are different approaches to field guides. You can try to cover a bigger area less comprehensively, which appeals to a larger market, might attract a commercial publisher/distributor, and with luck and good material may allow second and later editions to cover more taxa – Fairley and Moore's excellent *Native plants of the Sydney region* is case in point. Or you can, as with this book, focus intensively on a single rich exemplar area within a region, keep the product cheap by self-publishing, and fill a more local but very real knowledge gap. The result may be nominally specific to a small area, but if done well it will in practice have much broader value. *Native Plants Hassans Walls* is an essential piece of kit for the western Blue Mountains from now on.

Bob Makinson, Royal Botanic Gardens Sydney

Plant Germplasm Conservation in Australia

Strategies and guidelines for developing, managing and utilising *ex situ* collections

Fully revised edition 2009 | Edited by C.A. Offord and P.F. Meagher

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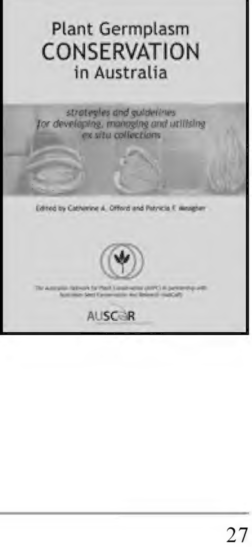
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strategies and guidelines for developing, managing and utilising ex situ collections
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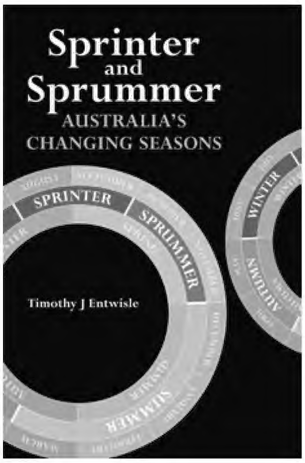
Book reviews (cont.)

Sprinter and Sprummer: Australia's Changing Seasons

Timothy J Entwisle

CSIRO Publishing, 2014
184 pages with illustrations and maps
ISBN 9781486302031



In Australia we have adopted a very English view of seasons based on patterns that seem to work well in somewhere like London. But how well does the concept of four-evenly spaced seasons really work here in Australia (or in other parts of the world for that matter)? Tim Entwisle brings together a range of long term observations and data from the natural world (in particular plants) to argue that in Australia, we need to rethink our concept of the four seasons.

Sprinter and Sprummer: Australia's Changing Seasons covers the background behind how Australia adopted the four season concept (Chapter 1). There is a comparison of what Aboriginal Australians thought about the seasons (Chapter 2) by transporting the reader to many different parts of the country to see what different Aboriginal groups considered to be seasons or seasonal patterns of note. Tim then gives his proposed alternative system of five seasons (Chapter 3). This involves a short two month (August–September) Sprinter (Chapter 4) when flowering of many native plants climbs to its peak, followed by a transitional season – Sprummer (October–November; Chapter 5) – characterised by ongoing but declining flowering and warming weather which signals the approach of Summer. Summer (Chapter 6) spans four months from December to March and is the warm, hot and or sticky time when there is much fruiting (generally in early Summer) of both native and non-native plants (e.g. mangoes). In Autumn (April–May; Chapter 7), things cool and the fungal fruiting season is at its peak. Winter (June–July; Chapter 8) is coldest and marks the beginning of renewal (e.g. budding in preparation for Sprinter). The book ends with a consideration of how seasons are not constant, but changing, and how to think about seasons under a changing climate (Chapter 9).

Having lived and worked in Australia, from the coast to the arid interior, it was apparent to me that the four seasons we inherited from Europe do not always work too well here. *Sprinter and Sprummer* provides a wealth of examples of why this is so and how we might go about improving our view of seasons. Tim does not make this a serious, dry pursuit, but rather a light but well considered and clearly documented presentation of the problems with the current scheme of seasons and ideas for what might work better. He presents a number of alternate schemes, along with his own.

Tim states in the introduction that the aim of the book is really to make people think and discuss ideas. I think the book does this, providing many examples to make the reader ponder the relationships between seasonal patterns and nature. Tim suggests his scheme is probably best suited to south-eastern Australia and he stresses the need for different schemes for different areas, along with local adjustments for things such as mountainous habitats. So it is not meant to be a book that fits all of Australia, but rather a way to make you think about what seasonal patterns would make sense in your regional area. I particularly liked the way Tim linked his seasonal scheme to changes he sees in Australian plants (the majority of examples) and animals. For example, most wattles flower in August, before both traditional Spring and Wattle Day. Data on peak flowering show that the transition from the lowest to the highest number of species flowering is in August–September (matching Tim's Sprinter). Other plants are clearly associated with certain seasons (mass fruiting in early Summer, flowering in the hyacinth orchid and *Persoonia* spp. in Summer, flowering in banksias in late Autumn and Winter). Tim also includes a number of animal examples (e.g. fat spiders in Autumn). The idea of linking our seasons to changes in the natural world seems to me to be a way to make people more aware of the changes that are occurring to our plants and animals. We face a time of increasing threats to and declines in biodiversity combined with impacts from a changing climate. If re-thinking our concept of seasons based on changes in the natural world helps to make people more aware of these issues, then I am all in favour. *Sprinter and Sprummer* leads us on this journey.

Book reviews (cont.)

Should we move to a new seasonal scheme? I think people do have some things they clearly associate with seasons. Where I live in the Sydney region, summer is hot, winter cold(er) but mild, spring is flowering time. Overall, the suggested changes Tim presents line up better with this pattern than the current three month seasons (the hot period extends to March, winter is only short, flowering is in full swing in August). Perhaps there could be an easy transition in some places. It will not work everywhere, but it has made me think and really that was the purpose of the book. I suggest that everyone who works on natural systems read this book, see what works in their local/regional area, think about the temporal patterns of the plants and animals, think about what seasonal patterns are relevant to biodiversity, talk to others about it and see if a greater appreciation of the changes occurring in nature can be cultivated. If we are to conserve our plants and animals in the long term we will need more public engagement with the natural world – *Sprinter and Sprummer: Australia's Changing Seasons* may just be one way to start that conversation.

Tony Auld, NSW Office of Environment and Heritage

Ten Commitments Revisited: Securing Australia's Future Environment

Edited by David Lindenmayer, Stephen Dovers and Steve Morton

CSIRO Publishing, 2014
352 pages with photographs and line art
ISBN: 9781486301676

TEN
COMMITMENTS
REVISITED
Securing Australia's Future Environment
Editors:
David Lindenmayer, Stephen Dovers
and Steve Morton

This book identifies for various ecosystems, sectors and cross cutting themes, "ten key issues that must be addressed urgently to improve Australia's environment", and provides an updated review of the well-received *Ten Commitments: reshaping the Lucky Country's Environment* (Lindenmayer et al. 2008). Written by more than 50 of Australia's leading environmental thinkers, the book provides valuable insight into current and emerging environmental issues with a strong focus on solutions.

The authors provide an overview of changes in research, policy and on-ground action since 2008, and present a fair evaluation of Australia's progress, retrogression and "dithering" in relation to each ecosystem, sector and cross-cutting theme. Rather than focusing on the negatives, the authors concentrate on what needs to be done next, and have revised the key issues outlined in each chapter to reflect changing priorities. Compared to the 2008 volume, new chapters address islands, soils, manufacturing and protected areas. The authors recognise that some important ecosystems and sectors may be missing (e.g. chapters on Antarctica and horticulture were commissioned but not received) and envisage that a future volume may address these gaps. A final synthesis chapter focuses on a few emergent themes, which unsurprisingly include managing impacts of human populations, climate change, and establishing a long-term vision and investment in environmental management and policy.

The authors make compelling arguments for focused action and investment to tackle Australia's environmental problems, with strong consideration of socio-economic as well as ecological impacts. While some recommendations seem idealistic, they should continue to stimulate progress in action and research. It is clear that while some of the tasks recommended in the 2008 volume have received attention, a much greater commitment is needed to sustainably manage our natural resources. To quote Woinarski et al. (Islands chapter, p. 127): "There needs to be a long-term commitment to a more systematic approach to the conservation management of…Australia's…important biodiversity resources…"

Overall, the book is concise and well-structured, enabling readers to flick to an area of interest and quickly gain broad insight into Australia's environmental issues and solutions of varying specificity, including policy changes, on-ground actions and research. A highly recommended read for anyone interested in fixing environmental problems, and hopefully for others yet to appreciate the seriousness of the challenges ahead.

Zoe Knapp, Department of the Environment

Research Roundup

Compiled by Kirsten Cowley

Centre for Plant Biodiversity Research, Canberra. Email: Kirsten.Cowley@csiro.au

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Research Roundup (cont.)

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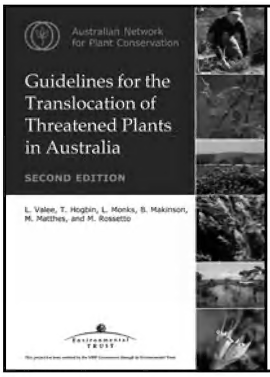
Contributions to Research Roundup are welcome, and should be sent to Kirsten Cowley at the above email address using an email subject heading "APC Research Roundup" or similar. Their inclusion will be subject to available space.


Australian Network for Plant Conservation
Guidelines for the Translocation of Threatened Plants in Australia
SECOND EDITION
L. Valee, T. Hogbin, L. Monks, B. Makinson, M. Matthes, and M. Rossetto
Environmental Trust

Guidelines for the Translocation of Threatened Plants in Australia

The deliberate transfer of plants or regenerative plant material from one place to another (eg re-introduction, introduction, re-stocking).

Second Edition 2004 | L. Vallee,T. Hogbin, L. Monks, B. Makinson, M. Matthes and M. Rossetto Australian Network for Plant Conservation, Canberra.

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Sydney Olympic Park Authority, NSW

University of Melbourne, Burnley Campus, VIC

National Seed Science Forum 2016

14–16 March 2016 | Australian Botanic Gardens, Mount Annan, NSW

AUSTRALIAN SEEDBANK PARTNERSHIP

SAVE THE DATE

The Australian Seed Bank Partnership is pleased to invite you to participate in a National Seed Science Forum in March 2016. The Forum will be held at the Australian PlantBank and hosted by the Australian Botanic Garden, Mount Annan, in collaboration with the Australian Network for Plant Conservation and the Australian Grains Genebank.

The Forum will commence with an evening event on Monday 14 March with the main science programme being presented on 15-16 March 2016.

The Forum will be a rare opportunity to bring together leading botanical and agricultural institutions, seed scientists, and conservation and restoration experts to share ideas that showcase the importance of seed science to the future of plant conservation and food security in Australia.

An exciting programme of local and international experts is planned, speaking on seed conservation, storage, preservation and germination. More details on the National Seed Science Forum will be provided in the near future. Invited keynotes and a call for presentations will be announced soon. Please email: info@seedpartnership.org.au to register for Forum announcements.

Visit the Forum web pages at: www.seedpartnership.org.au

Please share information on this Forum with your colleagues and through your networks.

The Australian
BOTANIC GARDEN
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FREE native seed provenance workshops

This series of six workshops, funded by the NSW Environmental Trust, will be held across NSW during June and July 2015. Hear presentations by key plant geneticists and expert native seed practitioners regarding the current best understanding of provenance issues for planning and implementing ecological restoration. This will be particularly relevant to plant population structures, decline, distribution and gene flows acknowledging climate variability.

The workshops aim to empower participants with knowledge of the implications and potential solutions for project planning, seed sourcing and related logistics of genetic tracking. They will also discuss monitoring for long-term success, resilience and sound investment in projects. And seek to answer the question - what is the definition of 'local provenance' in relation to conserving the genetic integrity of native vegetation?

The target audiences are Local Land Services project managers and staff, natural resource managers, seed suppliers, nurseries, revegetation / restoration contractors, Landcare groups, landholders and anyone interested in native plants or conservation in an ever changing world.

Workshop dates and locations will be announced soon. Keep up to date at: **http://anpc.asn.au/workshops**

For more information contact
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